

Of the alkylphenoethoxylates, polyethoxylated nonylphenols having between 8 and 12 moles of ethylene oxide per mole of nonylphenol are preferred. An example nonylphenol, 2, 6, 8-Trimethyl-4-nonyloxypolyethyleneoxyethanol is commercially available, e.g., from Union Carbide under the trade designation "TERGITOL TMN-10". Another nonylphenol ethoxylate NP-9 available from Shell under the trade designation "NP-9EO", added at 1000-3000 ppm. A preferred alcohol ethoxylate is a C₁₁ alcohol ethoxylate with 5 moles of ethylene oxide per mole of alcohol commercially available from Shell as "NEODOL N1-5 Surfactant". Additional preferred surfactant components include, for example, Pluronic 17R-2 [octylphenoxypolyethoxyethanol] (a block copolymer produced by BASF) added at 100 - 300 ppm; CA-720 an octylphenol aromatic ethoxylate available from Rhone-Poulenc as "IGEPAL CA-720" added at 1000-3000 ppm; and X-102 an ethoxylated alkyl phenol available from Union Carbide as "TRITON X-102" added at 1000 - 2000 ppm.

The fuel composition preferably includes one or more lubricants to improve the slip of the water phase and for continued smooth operation of the fuel delivery system. The amount of lubricant generally ranges from about 0.04% to 0.1% by weight, more preferably from 0.04% to 0.05% by weight. Suitable lubricants include a combination of mono-, di-, and tri-acids of the phosphoric or carboxylic types, adducted to an organic backbone. The organic backbone preferably contains about 12 to 22 carbons. Examples include mixed esters of alkoxyated surfactants in the phosphate form, and di- and tri-acids of the Diels-Alder adducts of unsaturated fatty acids. The carboxylic types are more preferred because of their ashless character. A specific example of a suitable lubricant is DIACID 1550™ (Atrachem LATOL 1550 or Westvaco Chemicals DIACID 1550), which is preferred due to its high functionality at low concentrations. The DIACID 1550 also has nonionic surfactant properties. Neutralization of the phosphoric and carboxylic acids, preferably with an alkanolamine, reduces possible corrosion problems caused as a result of the addition of the acid. Suitable alkanolamine neutralizers include amino methyl propanol, triethanolamine, and diethanolamine, with amino methyl propanol (available from Angus Chemical under the trade designation "AMP-95") being preferred.

02 Preferred compositions include about 0.05 to 0.4% by weight neutralizer, more preferably about 0.06%.

03 The fuel composition may also include one or more corrosion inhibitors, preferably one that does not contribute a significant level of inorganic ash to the composition. Aminoalkanoic acids are preferred. An example of a suitable corrosion inhibitor is available from the Keil Chemical Division of Ferro Corporation under the trade designation "SYNKAD 828". Preferred compositions include about 0.05% by weight corrosion inhibitor.

04 The fuel composition may also include one or more ignition delay modifiers, preferably a cetane improver, to improve fuel detonation characteristics, particularly where the fuel composition is used in compression ignited engines. Examples include nitrates, nitrites, and peroxides. A preferred ignition delay modifier is 2-ethylhexylnitrate (2-EHN), available from Ethyl Corporation under the trade designation "HITECH 4103". Ammonium nitrate can also be used as a cetane improver with the additional benefit of possessing emulsion stabilization properties. Preferred compositions include about 0.1% to 0.4% by weight ignition delay modifier.

Paragraph 25:

05 The fuel composition may also include one or more coupling agents (hydrotropes) to maintain phase stability at high temperatures and shear pressures. High temperature and shear pressure stability is required, for example, in compression ignited (diesel) engines because all the fuel delivered to the injectors may not be burned to obtain the required power load in a given cycle. Thus, some fuel may be recirculated back to the fuel tank. The relatively high temperature of the recirculated fuel, coupled with the shear pressures encountered during recirculation, tends to cause phase separation in the absence of the coupling agent. Examples of preferred coupling agents include di- and tri-acids of the Diels-Alder adducts of unsaturated fatty acids. A specific example of a suitable

05 coupling agent is DIACID 1550, neutralized with an alkanolamine to form a water soluble salt. Suitable alkanolamine neutralizers include amino methyl propanol triethanolamine, and diethanolamine, with amino methyl propanol preferred. The amount of the coupling agent typically ranges from about 0.04% to 0.1 % by weight, more preferably 0.04 to 0.05%.

Example 1 Table:

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	Ppm	Percent
Diesel	(balance	67%
H2O	300,000	30.00%
MeOH	20,000	2.00%
X-102	1,600	0.16%
N1-5	800	0.08%
TMN-10	800	0.08%

DA-1550	400	0.04%
AMP-95	600	0.06%
SYNKAD 828	500	0.05%
2-EHN	3,700	0.37%

Paragraph 40:

07 The fuel composition was prepared by first mixing the DIACID 1550, AMP-95, SYNKAD 828, X-102, N1-5, and TMN-10 with the methanol. The mixture was agitated.

Example 2 Table:

Diesel Fuel	67%
Highly purified water	30%
Methanol	2.00%
2-EHN	0.37%
DA-1550	400 ppm
AMP 95	600 ppm
SYNKAD 828	500 ppm
N1-5	1000 ppm
NP9	3000 ppm

Example 3 Table:

Diesel Fuel	67%
Highly purified water	30%
Methanol	2.00%
2-EHN	0.37%
DA-1550	400 ppm
AMP 95	600 ppm
SYNKAD 828	500 ppm
TMN10	1000 ppm
NP9	2000 ppm
17R2	100 ppm

Example 4 Table:

Diesel Fuel	67%
Highly purified water	30%
Methanol	2.00%
2-EHN	0.37%
DA-1550	400 ppm
AMP 95	600 ppm
SYNKAD 828	500 ppm
N1-5	1000 ppm
TMN10	1000 ppm
CA720	2000 ppm

Paragraph 46:

For Examples 1 - 4: the diesel fuel was EPA Emissions Certification Diesel Fuel; the water was purified by reverse osmosis; X-102 is Union Carbide TRITON X-102; TMN-10 is Union Carbide TERGITOL TMN-10 surfactant; N1-5 is Shell NEODOL N1-5 surfactant; DA-1550 is Atrachem LATOL 1550 (or Westavco Chemicals DIACID 1550); AMP-95 is 2-amino-2-methyl-1-propanol; SYNKAD 828 is Ferro SYNKAD 828; 2-EHN is Ethyl Corp. 2-ethylhexyl nitrate; CA-720 is Rhone-Poulenc "IGEPAL CA-720"; NP 9 is Shell "NP-9EO"; and 17R2 is BASF "PLURONIC 17R-2".